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ABSTRACT

The focus of this study was on the identification of adolescents with physiologically based extreme behavior problems (explosive, hostile, aggressive type) through the use of evoked potential studies. Through interviews two distinct types of explosive behavior were identified based upon how individuals came out of the rage or explosive period. In one group, the individuals tended to be more disoriented and less aware of where they were and what happened. In the second group, individuals were able to recall their actions, yet were unable to exert control over their escalating behavior. An ex-post facto study evaluated the computerized auditory evoked potentials, visual evoked potentials, and electroencephalograms of 71 explosive adolescents. Preliminary findings indicated there were major differences between the explosive population and the control group in the areas of occipital response as well as deep negative responses in the frontal areas. The characteristics of these groups were so recurring that it is believed that by using them as markers it is possible to electrophysiologically identify those students who may potentially exhibit explosive behavior. It appears that the same intense occipital and temporal responses are evident at times in children 4 to 7 years old who may, or may not, have started exhibiting explosive tendencies. If individuals can be identified at this early age, it may then be possible to control the explosive behavior more effectively. (LLL)

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THE USE OF EVOKED POTENTIAL STUDIES IN THE IDENTIFICATION OF EXPLOSIVE ADOLESCENTS

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ABSTRACT

An ex-post-facto study evaluated the computerized auditory and visual evoked potential studies of 71 explosive adolescents. Subjects were a clinically referred subpopulation of 278 adolescents presenting a myriad of diagnoses, both inpatients at psychiatric hospitals and outpatients. The evoked potentials have a unique characteristic that may allow the identification of adolescents whose uncontrollable explosive, angry and sometimes violent outbursts have an organic basis. Medication results are reviewed.

THE USE OF EVOKED POTENTIAL STUDIES

IN THE IDENTIFICATION OF EXPLOSIVE ADOLESCENTS

> The high incidence of this behavior disorder [explosive release of voluntarily inhibited activity] during elementary school years and the evidence that such disorders may be precursors of adult sociopathy and psychopathology require critical evaluation of present diagnostic and therapeutic methods and intensive research into biochemical, physiological, and social causes of behavior disorders in childhood. (Stevens, Sachdev, & Milstein, 1968, p. 176)

The presence or absence of organic factors, regardless of origin, needs to be addressed in the development of programs and Individual Educational Plans (IEP) which actually assist adolescents at risk and decrease the recidivism or revolving door concept. In our clinical setting, we are treating, investigating and evaluating the neurophysiology of different groups; the psychotics, the depressed, the explosives, the hypomanics, the schizophrenics, the drug abuser, post encephalitics, etc. In the course of our evaluations, it became essential to clearly identify those factors in the profile of our patients which were outside of their control. Over several years it has become obvious that there is specific electrophysiological activity associated with explosive behavior.

OBJECTIVE:

The identification of adolescents with physiologically based extreme behavior problems (explosive, hostile, aggressive type) through the use of evoked potential studies is the focus of this paper. We are talking about children that tend to explode emotionally, though aggression isn't necessarily involved, nor is there always hostility in their actions. Typically, some small thing sparks an explosive outburst, and their behavior quickly escalates out of control. Through interviews with these individuals, we have identified two distinct types of explosive behavior. Upon coming out of the rage or explosive period there appears to be an identifiable difference between the two. In one group, the individuals tend to be more disoriented and less aware of where they are and what happened. If questioned about their behavior and what occurred, they have no recollection and appear confused. The second group on the other hand was able to recall their actions, yet were unable to exert control over their escalating behavior.

PERSPECTIVE/THEORETICAL FRAMEWORK:

Frank Elliott (1984) has defined **episodic dyscontrol** as

> ...not a disease per se but a symptom of many disorders, psychologic and physical. It is easily distinguished from the cold, calculated violence of predatory aggression and from rational anger evoked in normal persons by frustration, but all too often it is simply written off as just another case of bad temper, and no attempt is made to identify the underlying pathology or to institute prophylactic treatment. The results are often tragic, especially in the context of intrafamilial violence. (p. 123)

Episodic dyscontrol syndrome, which many times goes untreated or is addressed with behavior modification techniques, falls closest to the Organic Personality Syndrome diagnosis in the DSM-III-R. Looking at the diagnostic criteria of this disorder under A.(2) it states, "recurrent outbursts of aggression or rage that are grossly out of proportion to any precipitating psycho-social stressor". Also, there is a note that one is to specify "explosive type" if outbursts of aggression or rage are the predominant feature. In a review of the literature dealing with explosive individuals we find very little written. There has been research conducted dealing with aggressive individuals, and aggressive personalities, though many of these deal with different populations, many times prison populations, than the one we are concerned with. Williams (1969) reported 57% of 1250 prisoners to have abnormal EEG's (80% of these abnormalities involved the temporal lobe). Fields (1975) stated:

> That neurologic dysfunctioning has important prognostic implications for individuals with a history of assaultive behavior is also shown by the high frequency of abnormal EEG's found in the absence of clinically observable seizures: the frequency of EEG abnormalities is about 5-15% in the general population, 20-25% in neurotics, 55-75% in individuals who committed murder without motive or provocation, and even higher in those who were psychotic when the murder was committed. (p. 276)

There are articles that deal with temporal lobe seizures causing aggressive acts of behavior as well as frontal lobe seizures that cause aggressiveness in individuals. Fields (1975) states:

> It is important to emphasize, that in spite of the rarity of documented ictal rage in temporal lobe epileptics, the association of aggressive behavior and temporal lobe epilepsy is a real one. Most of the outbursts of rage or violent behavior in temporal lobe epileptics are, however,

> non-ictal in character. What is the significance of these non-ictal aggressive outbursts in temporal lobe epileptics? Two kinds of non-ictal aggressive behavior in temporal lobe epileptics have to be distinguished. The first type is aggressive behavior which occurs in conjunction with a seizure, but during the post-ictal confusional state. ...The second type of episodic violent behavior in temporal lobe epileptics is characterized by a low rage threshold. ...There is usually no evidence that this represents an epileptic seizure in the accepted sense. (p. 30)
>
> ...This author's experience is, however, like that of many others: that the great majority of the behavior disorders seen are interictal and that gross behavior disorders during seizures are, in fact, uncommon. (p. 276)

Blumer (1976) in researching the rage syndrome as it pertains to epilepsy states:

> A summary of the topic 'epilepsy and violence' can be detailed as follows: ...4. Some individuals who are not epileptic but have paroxysmal EEG abnormalities (temporal lobe sharp waves or spikes in particular) seem to be more prone to react with excessive violence than patients with overt seizures. The syndrome, however, is not well outlined and needs further investigation. (p.220)

There appears to be minimal research at this time that deals with the explosive individual. Drake (1988) reported the ability of computerized EEG and evoked potential studies to identify this syndrome in violent offenders, but not in non-violent offenders. While it is important to identify the explosive-prone individual before they become a statistic in the criminal justice system, it is even more crucial to identify this individual while still involved in the learning environment at school.

DATA SOURCE:

An ex-post-facto study of clinical patient data, gathered between January 1, 1988 and May 1, 1990, at Treasure Valley Neuroscience Center, Boise, Idaho, was completed on computerized clinical EEG's and evoked potential studies of 278 adolescents. In evaluating these individuals it became evident that there was a certain sub-population of adolescents who, when looking at their behavior, were explosive. These individuals presented many different diagnoses, though consistently in their background histories the terms explosive, aggressive or hostility tended to appear. We identified 71 (25.5%) of them with this type of behavior documented. The minimum age was 7, the maximum 17 with an average of 13.46 and a standard deviation of 2.8. There were

17 (23.9%) females and 54 (76.1%) males. The group consisted of 61 (85.9%) right handed and 10 (14.1%) left handed individuals.

METHODS/TECHNIQUES:

All adolescents included in this study had been administered: auditory evoked potentials (AEP) using the "odd ball" paradigm; visual evoked potentials (VEP), both eyes, left eye, right eye, using the checkerboard pattern-reversal paradigm, the flash; and, an electroencephalogram (EEG) following two minutes of hyperventilation. The data was recorded on a Bio-Logic Brain Atlas III system. The raw EEG data was analyzed using the Cooley and Tukey Fast Fourier Transformation method. All evoked potential data was subjected to an average reference procedure as described in R. Spehlmann's EEG Primer. The majority of abnormal activity appeared in the visual evoked potential studies, (both eyes, with the checkerboard pattern-reversal paradigm); the obligatory response to an auditory tone stimuli, and the cognitive response to the odd-ball stimuli in the AEP studies.

RESULTS/CONCLUSIONS:

"Withdrawal, moodiness, antisocial or aggressive behavior were positively correlated with abnormal amplitude (paroxysmal activity) on the EEG..." (Stevens, et al, 1968 p. 169) Preliminary findings indicate that there are major differences between the explosive population and the Bio-Logic control group in the areas of: intensity of the occipital response in all studies, including the AEP studies, where at inappropriate times it is the primary area of activation, temporal involvement both deeply negative and/or intensely positive, as well as deep negative responses in the frontal area, usually bilateral. It is interesting to note that the areas of the brain that appear to be most deviant from the control group are the same areas that are identified as causing rage reactions in epileptics. In this regard Gedye (1989) states:

> One implication is that the focus in assessing episodic aggression may shift more to careful scrutiny for ictal signs and less on analysis of presumed reinforcers of aggression. Management strategies can be developed based on awareness of the involuntary nature of these episodes, especially since medication does not always eliminate or reduce frontal lobe seizure activity. We can avoid using techniques which may exacerbate or prolong such outbursts, and can avoid punishing behaviors which are involuntary neurologic events. (p. 377)

EDUCATIONAL/SCIENTIFIC IMPORTANCE:

The characteristics of these groups are so recurring that we believe by using them as markers it is possible to electrophysiologically identify those students who may potentially exhibit explosive behavior. These "explosives" are usually treated with behavior modification or other socially oriented strategies. Yet, clinical case reviews suggest these treatment strategies will be met with limited success unless a regimen of medication and cognitive mediation techniques, or perhaps EEG biofeedback training, are implemented. Another interesting finding is that these same "intense" occipital and temporal responses are evident at times in children 4 to 7 years old who may, or may not, have started exhibiting explosive tendencies. If we can identify individuals at this early age, it may then be possible to control the explosive behavior more effectively. Through early identification and treatment we should enable more children to maximize their adaptation to the learning environment.

CRITERIA

Criterion #1:

On any two of the three tests administered, AEP Bank 1, AEP Bank 2, and VEP, there were two separate regions of the brain selected from: the frontal, the temporal, and the occipital, that displayed standard deviations in excess of three when compared to the control group.

Alternate Criterion #1:

On any two of the three tests administered, AEP Bank 1, AEP Bank 2, and VEP, there were two separate regions of the brain selected from: the frontal, the parietal, the temporal, and the occipital, that displayed standard deviations in excess of three when compared to the control group.

Criterion #2:

The amplitude of the P100 from the VEP was in excess of 11.0 microvolts.

DESCRIPTIVE STATISTICS

AEP Bank 1		AEP Bank 2		VEP B/E	
Frontal	77.5%	Frontal	78.9%	Frontal	53.5%
Temporal	83.1%	Temporal	70.4%	Temporal	57.7%
Parietal	71.8%	Parietal	60.6%	Parietal	60.6%
Occipital	59.2%	Occipital	56.3%	Occipital	40.8%

Percentage of group who met criterion #1:		
Any combination of two studies	73.2%	74.6%*
Both AEP studies	63.4%	
VEP and AEP Bank 1 study	42.3%	
VEP and AEP Bank 2 study	40.8%	
AEP Bank 1 study	81.7%	
AEP Bank 2 study	70.4%	
VEP study	50.7%	
All three studies	36.6%	
Percentage of group who met alternate criterion #1:		
Any combination two studies	85.9%	87.3%
Both AEP studies	73.2%	
VEP and AEP Bank 1 study	54.9%	
VEP and AEP Bank 2 study	50.7%	
AEP Bank 1 study	85.9%	
AEP Bank 2 study	78.9%	
VEP study	63.4%	
All three studies	46.5%	
Percentage of group who met criterion #2:		
VEP study (P100)	21.1%	

* This includes individual #29 who met criteria #2 only with no standard deviations on two studies, an unusual circumstance, isolated for purposes of this study.

INFORMAL FOLLOW-UP STUDY

Selected study group 71.

Able to contact 42.

HOSPITAL:

Medication Ordered: (36) 85.7%

Behavior:	Improve:	Same:
	88.1%	11.9%

POST-HOSPITAL:

Medication Ordered: Yes: 78.6% No: 21.4%

If Medication Was Ordered 78.8% is being taken as prescribed, 21.1% reported that prescribed medication was not being taken.

Note: Of reported instances of not taking medication 57.1% of parents stated they had taken subject off medication (even though behavioral improvement was shown). In 42.9% of cases not taking prescribed medication the subjects themselves refused to follow instructions.

BEHAVIOR:

Total group of contacted individuals:

Improve:	73.8%
Same:	23.8%
Worse:	2.4%

Medication Ordered and Taken:

Improve:	84.6%
Same:	15.4%

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